

1. (currently amended) A method for separating a nucleic acid of interest from a population of nucleic acid molecules, the method comprising;

providing a population of nucleic acid molecules comprising at least one nucleic acid sequence of interest, wherein said at least one nucleic acid sequence of interest includes a target nucleic acid sequence in the ~~vicinity~~ vicinity of a distinguishing element;

contacting said population of nucleic acid molecules with a first targeting element ~~in a first identification step~~, wherein said first targeting element binds specifically to said target nucleic acid sequence;

selectively attaching a separation group to said bound targeting element ~~in a second identification step~~, wherein attachment of said separation group is conditional on the presence of said distinguishing element in the vicinity of said bound targeting element;

immobilizing said bound targeting element via said attached separation group to a substrate, thereby forming an immobilized targeting element-separation group complex comprising said at least one nucleic acid sequence of interest; and

removing said immobilized targeting element-separation group complex comprising said at least one nucleic acid sequence of interest from said population of nucleic acid molecules, thereby separating said nucleic acid sequence of interest from said population of nucleic acid molecules.

2. (cancelled)

3. (previously amended) The method of claim 1, wherein said targeting element binds to said at least one nucleic acid sequence of interest at a sequence within 20 nucleotides of said distinguishing element.

4. (previously amended) The method of claim 1, wherein said targeting element comprises a nucleic acid sequence.

5. (original) The method of claim 4, wherein said targeting element is an oligonucleotide.

6. (original) The method of claim 5, wherein said oligonucleotide has an extendable 3' hydroxy terminus.

7. (original) The method of claim 6, wherein said separation group is an immobilizable nucleotide.

8. (original) The method of claim 7, wherein said immobilizable nucleotide is a biotinylated nucleotide.

9. (previously amended) The method of claim 8, wherein said separation group is attached to said targeting element by extending said oligonucleotide with a polymerase in the presence of said biotinylated nucleotide, thereby forming an extended oligonucleotide primer containing said immobilizable nucleotide.

10. (previously amended) The method of claim 3, wherein said targeting element is an oligonucleotide.

11. (original) The method of claim 10, wherein said separation group is an immobilizable nucleotide.
12. (original) The method of claim 11, wherein said immobilizable nucleotide is a biotinylated nucleotide.
13. (original) The method of claim 1, wherein said population of nucleic acids is a population of DNA molecules.
14. (previously amended) The method of claim 13, wherein said population of DNA molecules is a population of cDNA molecules.
15. (original) The method of claim 1, wherein said population of nucleic acid molecules is a population of RNA molecules.
16. (amended) The method of claim 1, wherein said distinguishing element is a single nucleotide polymorphism.
17. (original) The method of claim 1, wherein said substrate is a particle, bead, magnetic bead, or glass surface.
18. (previously amended) The method of claim 1, further comprising contacting said population of nucleic acid molecules with a second targeting element simultaneously with said first targeting element, wherein said second targeting element binds specifically to a second at least one nucleic acid sequence of interest in said population of nucleic acid molecules;

attaching a second separation group to said second bound targeting element;

immobilizing said attached second separation group to a substrate, thereby forming a second immobilized targeting element-separation group complex comprising said second at least one nucleic acid sequence of interest; and

removing said immobilized targeting element-separation group complex comprising said second at least one nucleic acid sequence of interest from said population of nucleic acid molecules, thereby separating said second at least one nucleic acid sequence of interest from said population of nucleic acid molecules.

19. (currently amended) A method for separating a nucleic acid of interest from a population of nucleic acid molecules, the method comprising;

providing a population of nucleic acid molecules comprising at least one nucleic acid sequence of interest, wherein said at least one nucleic acid sequence of interest includes a target nucleic acid sequence in the vicinity of a distinguishing element;

contacting said population of nucleic acid molecules with a targeting element attached to a separation group ~~in a first identification step~~, wherein said targeting element binds specifically to said target nucleic acid sequence;

selectively removing said attached separation group from said bound targeting element ~~in a second identification step~~, wherein removal of said separation group is conditional on the absence of said distinguishing element in the vicinity of said bound targeting element;

immobilizing to a substrate separation groups remaining attached to said targeting element, thereby forming an immobilized targeting element-separation group complex comprising said at least one nucleic acid sequence of interest; and

removing said immobilized targeting element-separation group complex comprising said at least one nucleic acid sequence of interest from said population of nucleic acid molecules, thereby separating said nucleic acid sequence of interest from said population of nucleic acid molecules.

20. (cancelled)

21. (previously added) The method of claim 13, wherein said population of DNA molecules is a population of genomic DNA molecules.